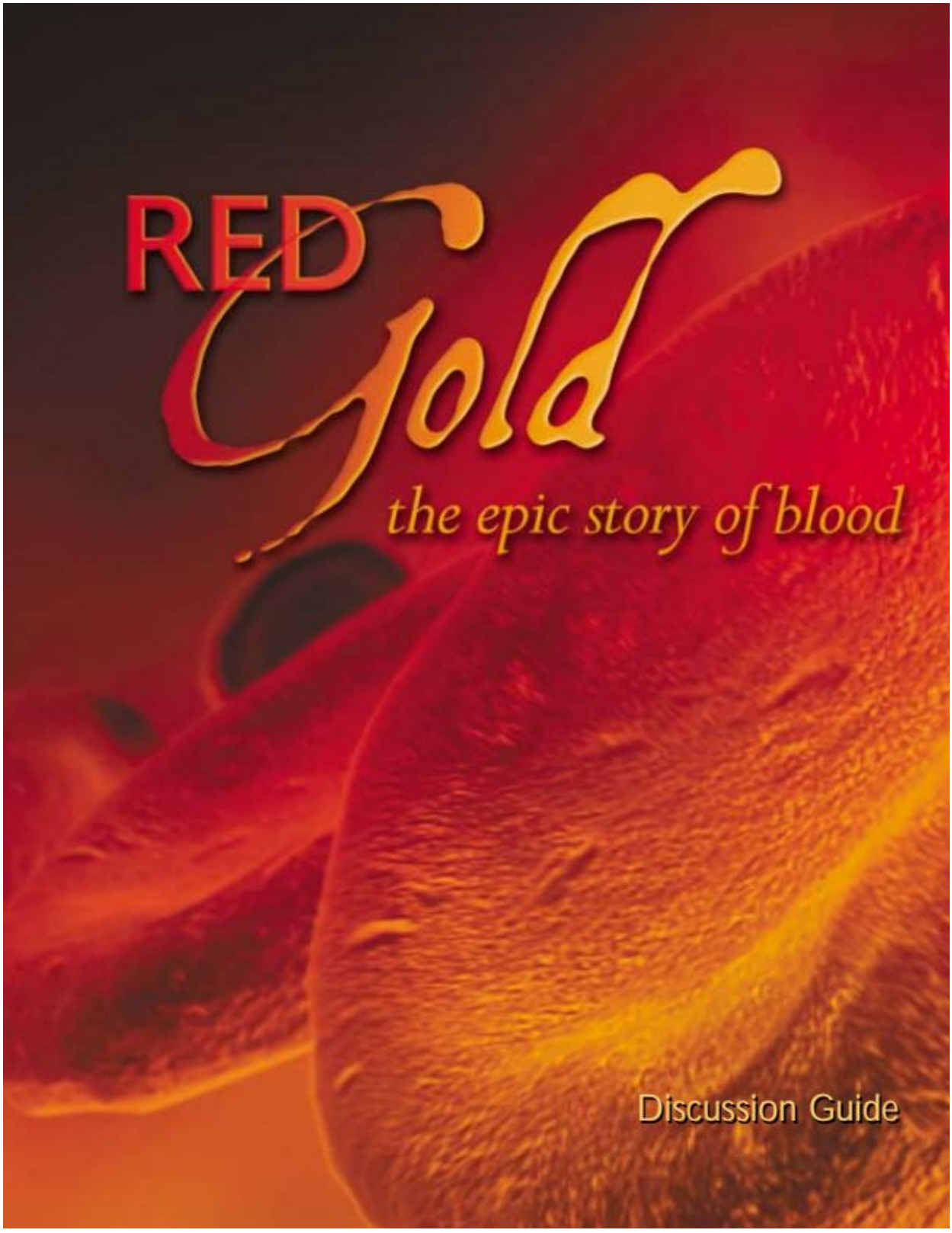
RED
Gold
the epic story of blood
Discussion Guide

RED GOLD THE EPIC STORY OF BLOOD

By Douglas Starr

Within hours of the September 11 terrorist attack, a spontaneous reaction took place. All across the nation, people lined up to give blood. They came by thousands, even after health officials told them they had more than enough. It wasn't medical necessity that brought people to the blood centers. It was the symbolic value of what they had to give.

Blood: It's strange that this most familiar of substances has always been so laden with feeling, so heavily freighted with mystery and symbolism. Consider the vocabulary: blood of our fathers; blood of Christ; the nation's blood; lifeblood; blood brothers, blood sacrament, blood libel....The history of blood involves not only medicine, but also culture and religion. It is a story of change — how a mysterious liquid became a global commodity and reflected the soul of each society that used it.

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A sign posted in the neighborhood of the World Trade Center after the tragedy.

FROM MAGICAL HUMOR TO MEDICINAL SUBSTANCE

For centuries people saw blood as a magical substance — a "humor" whose ebb and flow in the body mirrored the balance of elements in the universe. That belief was reflected in the Greek-based system of humoral medicine, in which health was maintained by bloodletting, among other things. But when 17th century doctors began performing dissections, they could see that blood was not a humor that ebbed and flowed, but a liquid that moved through a circulatory system.

English and French scholars of the time began to perform transfusion experiments, injecting blood from one dog into another and then from animals into men. The experiments were misguided — transfusing blood from an animal to a human can be fatal — but they represented a conceptual turning point. Rather than remove blood to maintain bodily balance, doctors considered injecting it to restore health. Another leap forward came in the early 1800s, when British obstetrician James Blundell transfused some of his patients with human blood. Nearly half survived. Given the primitive conditions and knowledge of the time, that was an impressive result.

Two critical advances in the early 20th century completed the transformation from magic to medicine — Karl Landsteiner's discovery of blood groups and Richard Lewisohn's development of an anticoagulant. These advances made it possible to remove blood from a donor, keep it from clotting long enough to transfuse it and make sure it was compatible and safe to the recipient. In the 1930s Soviet and American doctors developed the blood bank, making it possible to bottle and store blood.

The change could not have come at a better time, for the world was about to enter a period of unprecedented war, unparalleled bloodshed.

FROM MEDICINAL SUBSTANCE TO WARTIME MATÉRIEL

Doctors experimented with transfusions during World War I, but it was in World War II that blood became a strategic commodity. In the 1930s American doctors had learned how to separate blood into its different components and how to freeze-dry plasma. Then they learned how to break plasma itself into smaller components. Each component could be used for a particular purpose, such as staunching bleeding or fighting infections. Just as oil, that other great wartime resource, served as a raw material for fuels and petrochemicals, blood now became a raw resource as well for a host of life-saving pharmaceuticals. America produced an arsenal of blood products — including whole blood, freeze-dried plasma and albumin — which were shipped for use by GI's all over the world.

The enemy used almost no blood. Ignoring Allied research advances, the Nazis retreated into folk science and quackery, performing bizarre experiments to prove racial superiority. Furthermore, by accepting only "Aryan" donors, Germany severely limited its supply. The difference in approaches gave the Allies an advantage of tens of thousands of lives saved during the war.

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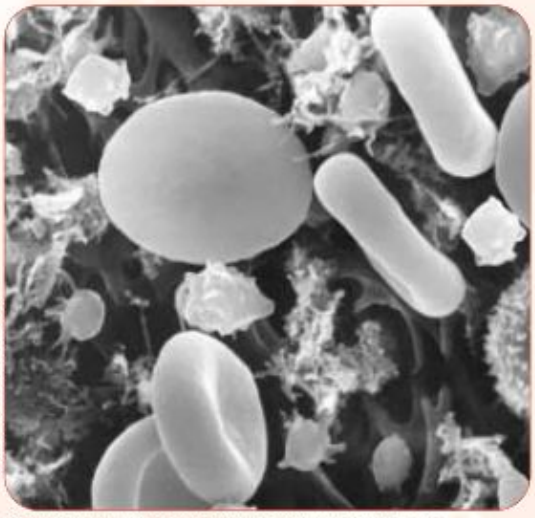
FROM WARTIME MATÉRIEL TO GLOBAL COMMODITY

World War II so clearly demonstrated the value of blood that setting up national blood systems became a postwar priority throughout the world. Blood use skyrocketed as blood-intensive surgeries, such as liver replacement, came into practice.

Soon an international trade in plasma derivatives developed, including such products as globulins and Factor VIII, the anticlotting agent used by hemophiliacs. The United States, with its liberal rules on plasma collection, became the "OPEC" of plasma. A dark side of the industry emerged, as "plasma mills" that accepted blood from drug addicts and indigents appeared in the skid rows of American cities. Other collection centers operated for a time in Central America and Southern Africa, sources of plentiful and cheap plasma.

By the mid-1970s so many blood products were flowing in so many directions that almost anyone in the developed world who needed these products could obtain them. That was good news for tens of thousands of people with hemophilia, who thrived with the global availability of Factor VIII. Yet the same system that so effectively collected, consolidated and distributed blood products also effectively distributed disease.

The RED GOLD series describes the HIV/AIDS and hepatitis scandals of the 1980s in which the blood establishments of several nations were accused of complacency, cover-ups or neglect — some fairly, some without cause. What is staggering to contemplate is how rapidly the public's image of the blood business plummeted. Few enterprises in history have been so thoroughly based on the public's good will. When the system faltered, the issue extended beyond public health and became one of broken faith and betrayal.



Electron microscope photo of red blood cells, platelets and a T-lymphocyte.

Private Roy W. Humphrey is given blood plasma after he was wounded by shrapnel in Sicily on 8/9/43.

THE QUEST FOR BLOOD SUBSTITUTES

Considering all the potential dangers associated with blood, some say that artificial hemoglobin could represent the future of the world's blood supply. Hemoglobin is the oxygen-carrying pigment in blood cells. Produced artificially, it might result in a liquid that can be stored at room temperature, administered to anyone regardless of blood type and remain free of pathogens such as hepatitis or HIV. Scientists have tried for years to develop such a product, which would represent the ultimate in safety and convenience.

Yet, would artificial hemoglobin be as safe and effective as its supporters claim? Recently, a form of the product was approved for use in South Africa. Based on hemoglobin derived from cow blood, the product represents an interesting step but falls short of replacing human blood. Unlike whole blood, the artificial hemoglobin can only carry oxygen for hours, not days. As such, it could be useful for emergency procedures but not for the long-term needs of a patient. It costs several times more than human blood, making it unaffordable to most of the world, especially at a time when availability is a concern. And even though this form of artificial hemoglobin has passed FDA testing, it is relatively untried compared to human blood. After all, it has been tested on a few thousand volunteers versus the tens of millions of people who have received human blood over the years.

So the quest for the holy grail of the blood world continues while we continue to rely on human volunteers.

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BLOOD IN THE POST-AIDS ERA

We now live in a pivotal moment in blood history. Because of research and new techniques, blood and its derivatives are safer than ever, yet the public's fear and suspicion remain high. A trust once broken takes many years to recover.

To ensure public safety and to recover that trust, health officials are approaching a zero-tolerance attitude toward pathogens. Recently, for example, the government put in place strict new rules barring people who have lived in Britain or Europe for specified times from giving blood. The purpose is to eliminate the threat of mad cow disease from entering the blood supply — a risk that many argue is nothing more than theoretical.

Such vigilance is good — nobody wants to be the one who allows in a single case of a new dreaded disease. Yet so much blood has been disqualified through safety measures that experts worry about our diminishing supply.

Will we have enough blood for the future — given that currently more than four million Americans receive blood transfusions each year, and this number is expected to increase? What should be the balance between absolute safety and a declining supply? The answers to such questions will determine the future of this familiar, yet ultimately mysterious substance.

Douglas Starr is co-director of the Knight Center for Science and Medical Journalism at Boston University and the author of Blood: An Epic History of Medicine and Commerce.

RESOURCES

BOOKS

Starr, Douglas, *Blood: An Epic History of Medicine and Commerce*, New York: Harper Collins Perennial Edition, 2002.

Institute of Medicine, *HIV and the Blood Supply: An Analysis of Critical Decisionmaking*, Washington, D.C.: National Academy Press, 1995.

Titmuss, R.M., *The Gift Relationship: From Human Blood to Social Policy*, New York: Pantheon, 1971.

Porter, Roy, *Greatest Benefit to Mankind: A Medical History of Humanity*, New York: W.W. Norton & Company, 1999.

WEB SITES

American Association of Blood Banks: www.aabb.org
America's Blood Centers: www.americasblood.org
American Red Cross: www.americanredcross.org
National Hemophilia Foundation: www.hemophilia.com
U.S. Centers for Disease Control: www.cdc.gov
U.S. FDA Center for Biologics Evaluation and Research (blood): www.fda.gov/cber/blood.htm
RED GOLD: THE EPIC STORY OF BLOOD (series Web site): www.pbs.org/redgold

Blood Donation Fact

Four and a half million Americans would die each year without blood transfusions.

DISCUSSION QUESTIONS

1. Despite the spike in donations following the September 11 terrorist attacks, donations in some parts of the country have now sunk to a near low point. Why might that be? Do people need an emergency to inspire them to give blood?
2. What prevents people from donating more routinely? Is it a question of awareness or, perhaps, convenience? What could the blood banks do to encourage more people to donate?
3. Should the government ban people who have lived in Britain from giving blood, even though the risk of mad cow disease has not been proven? What is the appropriate balance between safety and supply?
4. Should we properly see blood as the "gift of life" or as a commodity? What are the relative merits of each approach?
5. Currently men are banned from giving blood if they've had sex even once with another man. Other high-risk groups — such as drug users and men who have sex with prostitutes — are banned from giving blood for only a year since their last occasion of high-risk behavior. Should society reconsider its ban on gay donors? What health information would we need to make that decision?
6. With society facing continual blood shortages, should we consider paying people for their blood? That practice has long been discouraged as one that attracts high-risk donors. What information would we need in order to determine if such a practice could be safe?

Marie Andrews processes frozen blood donations from Portland, Oregon.

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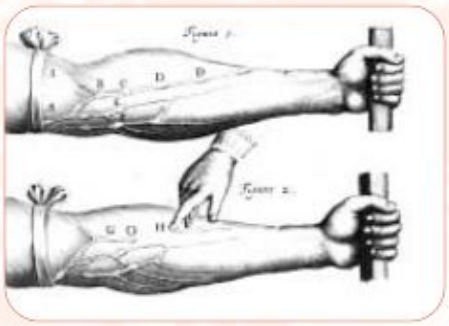
BLOOD: A HISTORICAL TIMELINE

460-377 BCE Hippocrates theorizes that four bodily humors—phlegm, blood, black bile, and yellow bile — must be kept in balance to maintain health. The four humors theory influences medicine for over 2 millennia and its cultural influence can be spotted today in personality descriptors like sanguine, choleric, melancholic, and phlegmatic.

129 - c. 201 CE Galen, a surgeon to gladiators and numerous emperors, studies the heart, veins and arteries. He concludes that the venous and arterial systems are not connected and that blood sloshes back and forth through the blood vessels.

1543 Publication of De Humanis Corporis Fabrica by Andreas Vesalius. Vesalius' book overturns many of Galen's faulty findings concerning human anatomy.



1628 Publication of On The Motion Of The Heart And Blood In Animals by English physician William Harvey (1578-1657). Using the scientific method, Harvey shows that the heart pumps blood through the arteries and that the blood returns to the heart via the veins.

1667 Jean-Baptiste Denis, a physician to Louis XIV, transfuses sheep's blood into Antoine Mauroy in hopes of calming his madness.

1818 James Blundell, a British obstetrician, successfully transfuses human blood from a husband to his wife to treat postpartum hemorrhage. Over an 11-year span Blundell transfuses ten patients, half of whom survive.

1901 Mixing blood samples from healthy individuals, Karl Landsteiner, an Austrian physician, observes agglutination of blood cells. He conducts further experiments and goes on to make one of the greatest discoveries in blood science: the A, B and O blood groups.

1915 Dr. Richard Lewisohn discovers that a 0.2 concentration of sodium citrate can be mixed with blood to prevent it from coagulating. The discovery makes it possible for doctors to store blood for longer periods of time without it clotting and it eliminates the need for donor and patient to be present simultaneously during a transfusion.

1930 Karl Landsteiner receives the Nobel Prize in Medicine for his pioneering research on blood and blood group systems.

1937 Bernard Fantus, a doctor at the Cook County Hospital in Chicago, begins America's first civilian blood bank, The Blood Preservation Laboratory.

Blood Donation Fact

Someone needs blood every eight seconds.

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1939 and 1940 Karl Landsteiner and his colleagues Alex Wiener, Philip Levine and R. E. Stetson discover the Rh blood group, which is believed to be responsible for the majority of adverse transfusion reactions.

1940 Edwin Cohn, a professor of biological chemistry at Harvard Medical School, develops cold ethanol fractionation, the process of breaking down plasma into its components, including the following proteins: albumin, gamma globulin and fibrinogen.

1950 Carl Walter introduces the plastic bag and associated tubing for the safe collection and storage of blood. The plastic bag eliminates the risk of bacteriological contamination and takes up less room than the traditional glass bottle.

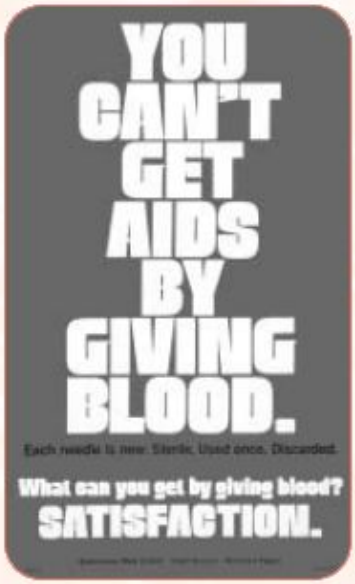
© NIH CENTRE

1954 Cryoprecipitate is developed for hemophiliacs.

1959 Max Perutz solves the complex molecular structure of hemoglobin.

1967 Rh immunoglobulin is commercially introduced to prevent Rh disease in the Rh-positive fetuses of Rh-negative women.

1971 First hepatitis B surface antigen screening tests begin in the United States.



1985 The first HIV screening test is introduced. The indirect test detects the presence of HIV antibodies, not the virus itself.

1990 The first hepatitis C virus (HCV) screening test is introduced. The indirect test detects the presence of HCV antibodies, not the virus itself.

1996 The HIV-1 Ag test is introduced, shortening the window period (the time interval between HIV infection and the appearance of anti-HIV antibodies) by an additional six to ten days.

2002 FDA approves the first NAT (nucleic acid test). NAT is a new, more sensitive gene-based test to screen the blood supply for HIV and hepatitis C. Blood centers all over the United States have been using NAT testing for almost three years under an FDA-sponsored research protocol. In that time, more than 30 million units of blood have been tested.

Blood Donation Fact

Approximately 37,000 pints of blood are used each day in the United States.

* UNLESS OTHERWISE NOTED, ALL TIMELINE PHOTOS COURTESY OF U.S. NATIONAL LIBRARY OF MEDICINE.

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FROM DONOR TO RECIPIENT: WHAT HAPPENS TO BLOOD DONATIONS

AT THE BLOOD DONATION CENTER

Healthy volunteer blood donors are recruited. (Generally must be at least 17 years old and weigh at least 110 pounds.)

A comprehensive health history is conducted by screening each potential blood donor. Up to 50 questions are asked during this procedure.

Volunteer blood donor gives the gift of life.

Blood is processed and separated into its component parts.

Red Blood Cells
benefit patients with chronic anemia or acute blood loss.

Platelets
benefit patients undergoing cancer therapy, recovering from organ and bone marrow transplants or with leukemia or aplastic anemia.

Plasma
benefits patients with severe liver disease, clotting deficiencies or serious burns.

Every unit of blood is tested to ensure patient safety:

HIV 1/2 — tests for antibodies to HIV-1 and HIV-2, test for HIV-1 antigen, and tests for HIV RNA.

HCV — tests for antibody for HCV, tests for HCV RNA.

HBV — tests HBV antigen and also tests for antibody to specific areas of the virus (HBc).

HTLV-I/II — test for antibodies to HTLV-I and HTLV-II.

Treponema pallidum (syphilis) — test for antibodies to a syphilis antigen.

ALT — test that measures a liver enzyme; when elevated it reflects liver inflammation which may be caused by hepatitis.

CMV — test for cytomegalo virus; used for special patients.

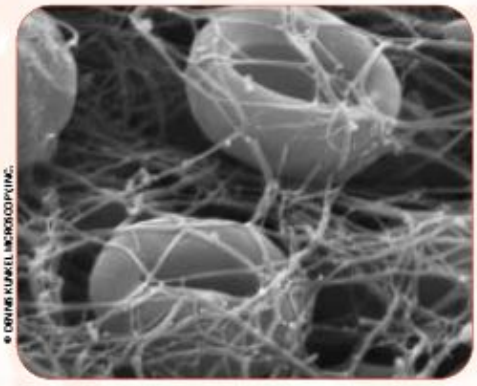
ABO/Rh — tests for blood group and type.

Antibody Screen — tests for unexpected red cell antibodies.

Crossmatch — the donor blood is tested with the potential recipients' blood prior to transfusion to determine compatibility.

ILLUSTRATION BY RAFAEL EUGENIO TRUJILLO

The above chart is adapted from the American Red Cross's "What Happens To Every Blood Donation?" Used by permission.



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A blood clot: red blood cells caught in a fibrin net.

An activated and a partially activated platelet.

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Blood Donation Fact

Of the four blood types (A, B, AB, O), blood centers most frequently run short of O and B blood. Shortages of all types occur during the summer and winter holidays.

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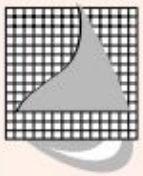
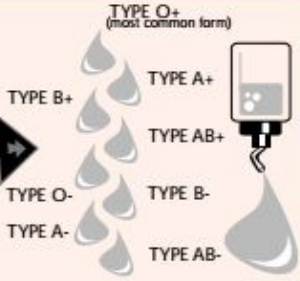
AT THE HOSPITAL

More than one half of blood products are filtered to remove leukocytes. This is done for patients who have had reactions to leukocytes and for patients with specific problems who are ill and may be transfused in the future.



Blood components are delivered to hospitals nationwide as needed and based on availability.

Blood components are labeled according to blood type and securely stored at appropriate temperatures.



When available, needed blood goes to patients.

BLOOD ESSENTIALS

WHOLE BLOOD

- Components include red cells, white cells, plasma, and platelets.
- Used only under special circumstances; for example, treating patients who are bleeding and have sustained severe blood loss.

RED CELLS (ERYTHROCYTES)

- There are millions of red blood cells in a drop of blood.
- Mature red blood cells do not have nuclei.
- Hemoglobin, a protein chemical that gives blood its red color, makes up 95 percent of the cells. It contains iron, which is used as a vehicle for transporting oxygen to cells and taking away carbon dioxide and other waste gases from cells throughout the body.
- Red blood cells are constantly recirculated through the body and have a life cycle of approximately 120 days.
- Red blood cells transport oxygen from the lungs to the organs and tissues and return carbon dioxide to be disposed of through respiration.
- Red blood cells are used to replace blood loss in surgery and accidents, and to treat patients with chronic anemias like sickle cell disease and thalassemias.

WHITE CELLS (LEUKOCYTES)

- There are usually 7,000 to 25,000 white blood cells in a drop of blood.
- White blood cells fight bacteria and infections. They do this by either devouring the bacteria or by producing antibodies that fight germs.
- People with leukemia, a cancer of the blood, may have up to 50,000 white blood cells in a drop of blood.
- White blood cells may be beneficial for sepsis patients.

PLASMA

- Plasma is the straw-colored liquid that carries red cells, white cells and platelets through the body. It is approximately 90 percent water.
- Plasma contains minerals such as sodium, calcium, potassium, and magnesium. It also contains sugars, dissolved salts, amino acids, hormones, important proteins, and lipids.
- Plasma is used for treatment of burns or shock, and to correct clotting problems in patients with liver disease and excess blood loss. Cryoprecipitate, a concentrate of clotting factors made from plasma, is used for treating hemophiliacs.

PLATELETS (THROMBOCYTES)

- Platelets are irregularly shaped fragments of cells that help to form blood clots. They do this by clumping and adhering to the walls of blood vessels at the site of a wound, hence stopping the bleeding. After a while, the clot hardens.
- Platelets are about one-third the size of red blood cells.
- Platelets are used for treating leukemia and other cancers.

HOW TO PLAN A SUCCESSFUL BLOOD DRIVE

HOW TO BEGIN

The first step in planning a blood drive is to meet with a blood collection center representative. Together, the two of you will set a blood collection goal. Then you will select a date and time that is convenient for the people you want to recruit. If possible, schedule your blood drive during the summer or near the holidays because those are the times of greatest need. (If, for example, everyone did a blood drive on April 7th, we would run out of red blood cells on May 19, since 42 days is the maximum time they can be safely stored by the blood banks. We would run out of platelets in only five days!) Pick a location that is easily accessible and, if appropriate, on public transportation routes. The location should be large enough to provide confidentiality while the donors are completing the forms and physical. It should also be well lighted, clean and have adequate restrooms.

PUT TOGETHER A RECRUITMENT TEAM

In general, expect to need about one person to recruit every 25 people you want to donate blood. For example, if your goal is to gather 125 pints of blood, you will need five recruiters. If you are organizing a blood drive in your office, select enthusiastic people who will be effective donor recruiters.

MOTIVATE TO RECRUIT

The most common reason people report for not donating blood is that nobody asked them! One-on-one recruiting is the most effective way to secure donors. So . . . ask! Call them. Send e-mails and reminders. Hang posters. Put a notice in your organization's newsletter. Post notices wherever people gather at your office, church or school. Motivate them to make a definite appointment to donate!

GET A COMMITMENT

Be sure each person who has agreed to donate makes an appointment. Send e-mails, postcards or other reminders to them as it gets closer to the scheduled date.

Some people can't give blood. Invite them to join your recruitment team to help you plan and organize a successful blood drive. They can also assist by making reminder calls to donors or by checking people in as they arrive at the donation site the day of the blood drive.

Blood Donation Fact

One unit of donated blood can help save as many as three lives.

THE DAY BEFORE THE EVENT

Call or e-mail your team to confirm the location, time and assignments. Be sure at least one person will be at the donation site well in advance of the first appointment to take care of any last minute details. You will also need to have signs that provide clear directions to the donation site.

FOLLOW-UP

People like to know they helped to meet the goal of the blood drive. Let everyone know how successful the drive was and how each person helped to meet the collection goal. If you meet your goal, celebrate! Be sure to thank everyone who volunteered as recruiters or during the day of the drive. And, don't forget to thank the donors!

ONCE IS NOT ENOUGH

People need blood every day. Plan in advance to hold multiple blood drives every year. Call your local blood collection center to schedule your drives for the year.

From *Be A Life Saver—Be A Blood Donor*. World Health Day 2000, American Association for World Health, Washington, D.C. 2000. Adapted from *How to Run a Successful Blood Drive*, The American Red Cross.

Philadelphia Police Commissioner John Timoney is prepared for blood donation by Cheryl Ellsworth, R.N.

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DISCUSSION QUESTIONS Please answer in blue text.

Names of people working on this document: first and last names please

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